MT 50000-10110

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JUL 12 2013

July 8, 2013

Ms. Wendy Cheung
EPA Region 8
1595 Wynkoop Street, 8P-W-GW
Denver, Colorado 80202-1129

RE: Application for Class V Underground Injection Control Well—Aquifer Recharge Wells
Stillwater Mining Company Benbow Exploration Decline
Stillwater County, Montana

Dear Ms. Cheung:

Enclosed please find the site information request fact sheet for the above-referenced project submitted on behalf of the Stillwater Mining Company (SMC).

This application is for a Class V injection control well for the disposal of groundwater produced from unmineralized rock while the Benbow Exploration Decline is being driven. This injection control well is proposed to minimize potential dewatering effects of the decline. SMC plans to expand its operation to the east of the existing Stillwater Mine and will be driving a new decline under its Montana Metal Mine Operating Permit #00118 to facilitate exploration activities in the near term, and long term, to provide secondary access and additional ventilation for its underground workings.

The injected water will be treated by sedimentation and biological treatment for the removal of nitrogen compounds from blasting agent residues and will meet drinking water quality standards prior to reinjection. All injection will occur approximately 1,050 feet below the inferred groundwater surface. The site is remote and the nearest drinking water wells are approximately 1.6 miles to the north-northwest of the proposed injection control well.

Should you have any questions regarding the enclosed materials, please give me a call at (406) 443-4150, Ext. 157. We appreciate your assistance in completing this permitting effort.

Sincerely,

Lisa M Boettcher

Lisa M. Boettcher, C.P.G.
Senior Geologist

Enclosure

UIC Class V File

UIC Permit #: MT 50000-10110

Permit	Inv Form	Inspec Report	Monitor Report	EPA Corresp	Operator Corresp	State Corresp
					X	

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Site Information Request Fact Sheet
Class V Underground Injection Control

Aquifer Recharge Wells

The Underground Injection Control (UIC) Program, created under the authority of the Safe Drinking Water Act (SDWA), is a preventative program aimed at protecting existing and future underground sources of drinking water (USDWs). Shallow wells or disposal systems that discharge fluids into the subsurface are known as Class V wells and can be authorized to inject by rule or permit. Class V wells that have the potential for ground water contamination or degradation are usually permitted. Those that do not have a potential to contribute to contamination or degradation of ground water are usually rule authorized, once inventory information has been submitted according to the requirements of 40 CFR 144.26. In addition to the inventory requirements, EPA may, under the authority of 40 CFR 144.27, require the owner or operator of any well authorized by rule to submit additional information to determine if injection activity could endanger a USDW. Rule Authorized wells do not require public notice or further monitoring of injection activities.

Artificial aquifer recharge (AR) is the enhancement of natural ground water supplies using man-made conveyances such as infiltration basins or injection wells. Aquifer storage and recovery (ASR) is a specific type of AR practiced with the purpose of both augmenting ground water resources and recovering the water in the future for various uses. While an AR well is used only to replenish the water in an aquifer, ASR wells are used to achieve two objectives: (1) storing water in the ground; and (2) recovering the stored water either using the same well or by pairing injection wells with recovery wells located on the same wellfield.

The following information is needed to evaluate the impact a shallow injection well/disposal system used for aquifer recharge will have on the local hydrogeologic system, potential for USDW contamination, and whether a **permit** for this operation, rather than a **rule authorization**, should be required.

Please provide the following information:

1. Property owner of facility including a physical and mailing address; phone and fax numbers.

Stillwater Mining Company – Stillwater Mine
PO Box 1330
Columbus, MT 59019
Phone: 406-322-8746
Fax: 406-322-8795

2. Operator of facility including a physical and mailing address; phone and fax numbers.

Same as Property Owner (#1)

3. Responsible party for the operation, maintenance, and closure of the injection system including a physical and mailing address; phone and fax numbers.

Randy Weimer, Environmental Manager
Address and phone numbers same as Property Owner (#1)

4. Contact persons representing any other state or local agencies that have an interest in the site including a physical and mailing address and phone number.

Ms. Traute Parrie
Beartooth District Ranger
Beartooth National Forest
6811 Hwy 212
Red Lodge, MT 59068
406-446-2103

Mr. Robert Cronholm
Environmental Management Bureau
Montana Department of Environmental Quality
PO Box 200901
Helena, MT 59620-0901
406-444-4330

5. A brief description of the project plan including the following:

Stillwater Mining Company (SMC) is pursuing the permitting of a new portal (Benbow Exploration Portal) in compliance with its Montana Department of Environmental Quality Metal Mine Operating Permit #00018. The lower portion of the decline would be dewatered as it is driven. This injection control well is proposed to minimize the potential dewatering effects of the decline. The location of the proposed underground injection control well collar is shown in Figure 1.

a) The source of injectate:

origin of gw?

The injectate will be groundwater that is treated to meet drinking water standards.

b) The injection procedures, injection rate, volume and pressure:

The treated groundwater will be pumped from the water treatment facility located near the proposed waste rock facility (Figure 2) to a storage pond or tanks, then injected into the target aquifer (Madison Formation) at an anticipated rate of 300 gpm (432,000 gallons per day), at pressures that would range from approximately 60 to 290 psi, depending on final casing and/or tubing diameter.

c) The intended receiving formation:

The intended receiving formation is the Madison Formation (Mission Canyon member).

d) The hydrogeology of the area:

The injection control well location is in an extremely remote area of the Custer National Forest, and would be constructed through Paleozoic-aged sedimentary rocks that were faulted and tilted to near-vertical orientation against the Archean Stillwater Complex in the Beartooth Mountains. Figure 2 is a geologic map of the area. Figure 3 is a geologic cross section showing the orientation of the sedimentary units and the proposed injection well collar. The inferred groundwater elevation of the area is indicated on Figure

3, and it is based on streamflow and one exploration drill hole. At this point, there is insufficient information to construct a potentiometric surface map.

Groundwater flow direction is assumed to be in a northwest or southeast direction along the strike of the Paleozoic rocks towards the Stillwater River or to smaller streams that eventually discharge to the Stillwater River. The streams in the area gain groundwater in their upper reach, but lose water as they flow across the Madison Formation. During low-flow periods, all streamflow recharges the Madison aquifer, and during high-flow periods, the streams flow along their entire reach.

e) The overlying and underlying aquifers that could be impacted:

Stratigraphically up-section (which is downslope) from the Madison Formation are the Amsden Formation (interbedded dolostone, siltstone, sandstone, mudstone) the Tensleep Formation (sandstone, mudstone and siltstone), and the Chugwater Formation (siltstone and sandstone). Stratigraphically down-section (which is upslope) from the Madison Formation are the Three Forks Formation (shale, siltstone, dolostone), the Jefferson Formation (limestone, dolostone), and the Bighorn Dolomite.

f) What is the effect of injection activities on these aquifers?

Although there is potential for injected fluids to enter other aquifers, the injectate is treated groundwater that will meet drinking water criteria. The injection activities are specifically designed to minimize water change in surrounding formations.

g) Public and private wells within 1 mile of the project area:

The proposed injection well is in a remote location in the Custer National Forest. There are no drinking water wells within 1 mile that would be affected. The closest drinking water well to the site is 1.6 miles and located downgradient (to the north-northeast) of the proposed injection area.

h) Whether wells are completed in the intended receiving formation, and

No domestic wells are completed in the Madison Formation in this area because it is at depth. The online Montana Bureau of Mines and Geology Ground Water Information Center database for this area does not list any well completions below the Judith River Formation and the Eagle Sandstone which are separated stratigraphically from the Madison Formation by 17 formations.

i) The effect of injection activities on these wells.

The injection of treated groundwater that meets drinking water standards would have no effect on domestic wells.

6. Determine the aerial extent of the aquifer(s) (i.e. fill-up volume) that would be impacted by the proposed injection based on the proposed injection volumes and rates. Identify all outcrops of the formation to receive injectate and any potential to create artificial springs. Identify mechanisms which will increase the volume of ground water infiltration into nearby surface water bodies. Identify all erosional intersections between the proposed formation to received injectate and potentially affected surface water drainage systems;

The geologic formations at this location are not horizontal but are dipping near-vertical (85°) in a fault block (Figures 2 and 3). The formations extend from surface to depth. SMC plans to drill the injection control well at -46°, collaring in the lower Kootenai Formation. The injection well would intersect the Upper Madison Formation at an elevation of about 5,200 feet amsl, which is a vertical depth of approximately 1,700 feet below ground surface and approximately 1,050 feet below the inferred groundwater elevation/elevation of Little Rocky Creek (Figure 3). The injection control well would inject below the 5,200 feet elevation, into highly permeable zones identified in the exploration drill hole as solution voids and backthrust fault rubble. Based on the observed capacity of the Madison Formation to receive streamflow (see 5.d. above), and the significant secondary porosity developed by solution, as well as fault zone rubble encountered in the exploration drill hole from the Benbow Portal Pad, it is expected that the permeability of the formation exceeds the rate and volume of water discharged as injectate, and mounding (i.e., fill-up volume) would be minimal.

7. Map of the site location (1:24,000 topographic map or similar)

Please see Figure 1.

8. Hydrogeologic description, location, depth, and current use (if any) of the receiving formations:

The Madison Formation is a Mississippian-aged limestone that is subdivided into the upper Mission Canyon and lower Lodgepole members. The Madison Formation forms limestone cliffs in the area of the injection well, and due to its near-vertical dip, extends from the surface to depth. The Madison Formation is approximately 700 feet thick (measured perpendicular from formation top to bottom along the section) at this location. The exploration drill hole verified that both the Mission Canyon and Lodgepole members contain significant secondary porosity developed by solution and fault zone rubble. Because this well is located within the Custer National Forest, there is no current use of the receiving formation within this fault block. Farther downslope, outside the Custer National Forest Boundary, the Madison Formation is at depth and is not used for drinking water purposes.

9. Provide groundwater flow rates for the receiving formation(s) (if a shallow unconfined aquifer(s))

The Madison Formation is an unconfined aquifer at this location; however, it extends to depth. Because this well is located within the Custer National Forest, there are no aquifer characteristic data available.

10. Aquifer characteristics: transmissivity, storage coefficient, hydraulic conductivity, saturated thickness, information from drawdown tests and specific capacity;

Because this well is located within the Custer National Forest, there are no aquifer characteristic data available. Packer and dye testing will be performed to verify aquifer characteristics once the injection well is completed.

11. If injection is into an alluvial aquifer, provide locations of surface water bodies, i.e. rivers, streams, and lakes, within one mile of the injection site (may substitute topographic map);

Not applicable.

12. Analysis of the water to be injected including constituents regulated under the Safe Drinking Water Act (SDWA), major anions and cations, ambient temperature and pH, presented as tabular data;

Groundwater would be removed as the decline is driven through unmineralized rock during dewatering activities and reinjected after treatment to meet drinking water standards. No water quality data are available for groundwater in bedrock at this location. However, 2012 treated water quality data from the nearby Stillwater Mine are included as Table 1 to illustrate the effectiveness of biological nitrogen treatment employed by SMC. The table also includes major anion, cation, and temperature data, as available. Item 18 describes SMC's treatment system in detail.

13. If available, analysis of the fluids in the receiving formation(s) including constituents regulated under the Safe Drinking Water Act (SDWA), major anions and cations, ambient temperature and pH, presented as tabular data;

No water quality data are available for groundwater in the Madison Formation at this location.

14. To evaluate the impact of injected water on the receiving formation, plot the major anions and cations from the above analyses of the injectate, the receiving formation fluids, and mixed fluids on a trilinear diagram or Piper diagram. Provide a brief assessment regarding the compatibility of the injected water and the receiving formation fluids;

Because the injectate would be groundwater from unmineralized bedrock that would be treated to remove sediment and nitrogen, there are no expected incompatibilities with receiving formation fluids.

15. To identify any potential mineralogical constituents in the receiving formation that might be mobilized as a result of injection activities, provide chemical analysis of core samples from the receiving formation and results from column leachate tests simulating the chemical conditions of injection activities;

All injection would occur approximately 1,050 feet below the inferred groundwater surface and there are no potential mineralogical constituents in the receiving formation other than calcium and calcium-magnesium carbonate that may be mobilized as a result of injection activities.

16. Completion diagram showing the construction plans for the proposed injection well(s);

Please see Figures 4a and 4b that provide conceptual construction alternatives for injecting water into the Madison Formation. Figure 4a is a schematic diagram that uses an uncased injection interval that is open in the Madison Formation. Figure 4b is a schematic diagram that uses an injection tubing to inject water into the Madison.

17. A brief description of contingency plans for treating the well(s) to prevent or remediate bacteriological or mineral buildup in the well, which could affect the injection operation;

Filtration and chlorination will be employed, if necessary; however, given the open character of the solution channels and fault zone rubble in the Madison Formation, no problems with bacteriologic or mineral buildup in the well are anticipated.

18. Briefly describe planned treatment of injectate proposed prior to injection, such as filtering to remove particulates which might plug the receiving formation;

The injectate would be groundwater that enters the Benbow Exploration Portal decline as it is driven through unmineralized rock. Conventional drill and blast methods will be used to drive at least a portion of the decline. Sedimentation for removal of solids followed by biological nitrification and denitrification (as needed to treat blasting residues) would be employed at the location as treatment prior to reinjection.

The biological treatment is a two-stage moving bed bioreactor that employs HDPE bacterial growth media suspended in the water column. In the first stage (nitrification), an air blower system adds oxygen and circulates the water so that microbes can oxidize ammonia-nitrogen to nitrate-nitrogen. In the second stage (denitrification), the oxygen is limited so the microbes can denitrify nitrate-nitrogen to nitrogen gas. The Stillwater Mine's average nitrogen removal rate typically ranges from 89 to 98 percent, and the treatment retention rate can be adjusted as needed to optimize treatment efficiency. While conventional drill and blast methods are used, nitrogen compounds (ammonia, nitrate, and nitrite) will be treated to concentrations below drinking water standards prior to reinjection (Table 1).

The data presented in Table 1 represent the quality of influent groundwater derived from dewatering the workings at the Stillwater Mine and post-treatment effluent. In 2012, SMC employed sedimentation and only a denitrification circuit for its biological treatment. The biological treatment for groundwater intercepted from the Benbow Exploration Portal would employ both nitrification and denitrification biological treatment, as is done at SMC's East Boulder Mine. The East Boulder Mine achieves an average ammonia species nitrogen removal rate of 90.7 percent. Similar nitrogen removal rates are anticipated at the SMC Benbow Exploration Portal biological treatment plant, so that the probable average effluent ammonia concentration (injectate) would be 0.2 mg/L, meeting drinking water quality standards.

19. Briefly describe the proposed monitoring program, including tracking of injectate volume, proposed for the operation;

The monitoring program will employ a metering pump to track injectate volume, pressure sensors for injection pressure (and for annular space pressure, if required), and weekly end-of-pipe sampling of water quality prior to injection (or on an alternate schedule as required by Montana DEQ).

20. Presence of any ground water contamination plumes near the project area that could affect or be affected by injection activity;

No groundwater contamination plumes are present near the project area.

21. A description of any known surface water-subsurface water interactions which may be affected by injection activities;

Because the treated groundwater will be injected approximately 1,000 feet below the inferred groundwater surface, no surface water-subsurface water interactions are anticipated.

22. Provide the name of the operator of the recovering facility including Public Water System (PWS) Identification number, a physical and mailing address, and phone numbers;

No groundwater recovery is planned.

23. Provide the location and a description of any PWS drinking water wells or springs which will be recovering water from this aquifer (may be marked on topographic map indicating proposed injection wells, nearby surface water bodies, and locations of recovery wells at the recovering PWS, as well as identify PWS identification number and name of the next two closest PWSs);

No groundwater recovery is planned.

24. If injectate is treated water, does it contain chlorinated compounds? Is recovered water expected to meet current drinking water standards? If not, what exceedances are expected;

No chlorinated compounds are present in groundwater at this location. Groundwater will be treated to meet current drinking water standards prior to reinjection; however, no groundwater removal is proposed. No exceedances are expected.

25. Describe effect of injectate on the water-bearing formation and the groundwater: reaction products or by-products that are anticipated;

No groundwater reaction products or by-products are anticipated.

26. Provide bench scale testing results, if available;

No bench-scale testing has been performed.

27. Describe the proposed treatment to be used by any PWS recovering water from this aquifer to meet the National Primary Drinking Water Regulations; and

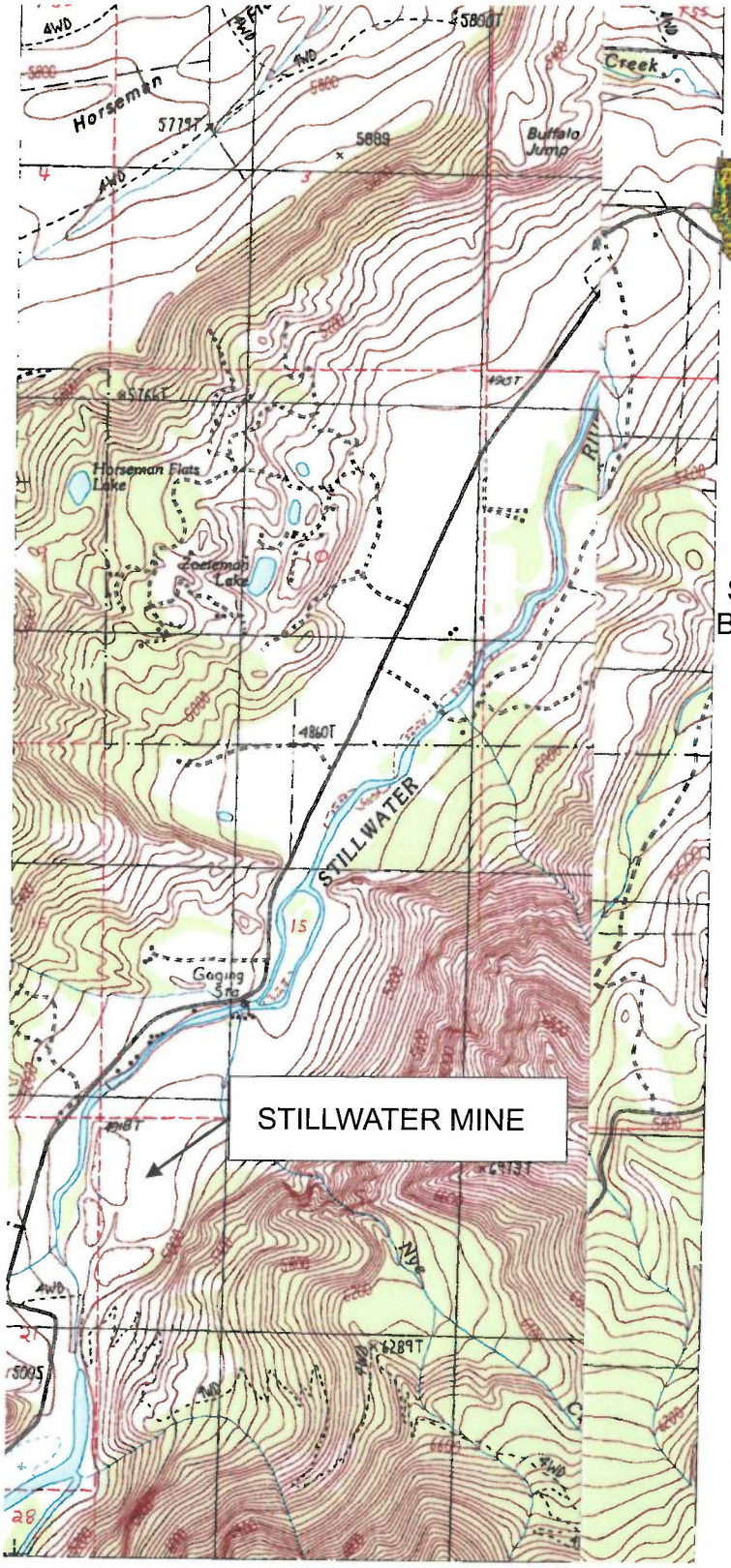
No groundwater recovery is planned.

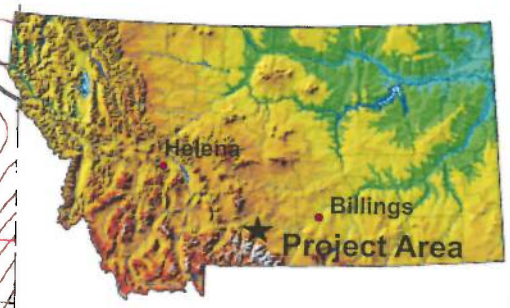
28. Identify whether or not the recovered water will be regulated and treated as groundwater under the direct influence of surface water.

No groundwater recovery is planned.

Send information to:

Wendy Cheung
EPA Region 8
1595 Wynkoop Street 8P-W-GW
Denver, Colorado 80202-1129
Phone 1-800-227-8917 x 6242 or 303-312-6254 FAX (303)-312-7084
cheung.wendy@epa.gov





STILLWATER MINING COMPANY
BENBOW EXPLORATION PORTAL
CLASS V
UNDERGROUND INJECTION
CONTROL WELL APPLICATION
JULY 2013

SITE MAP

FIGURE 1

SCALE: 1 MILE

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TOPOGRAPHIC MAP
CONTOUR INTERVAL
40 FEET

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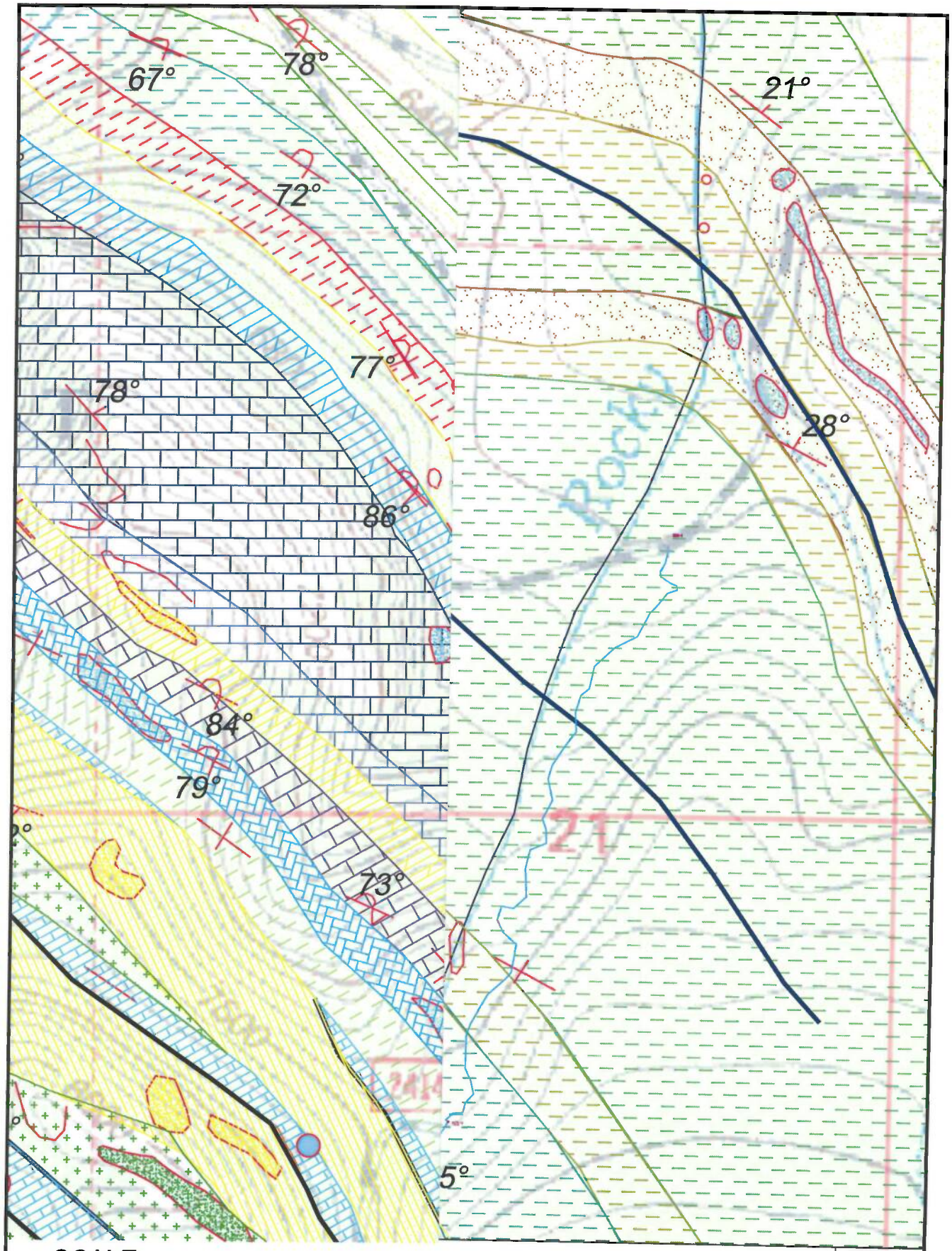

SCALE
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GEOLOGIC MAP

FIGURE
2

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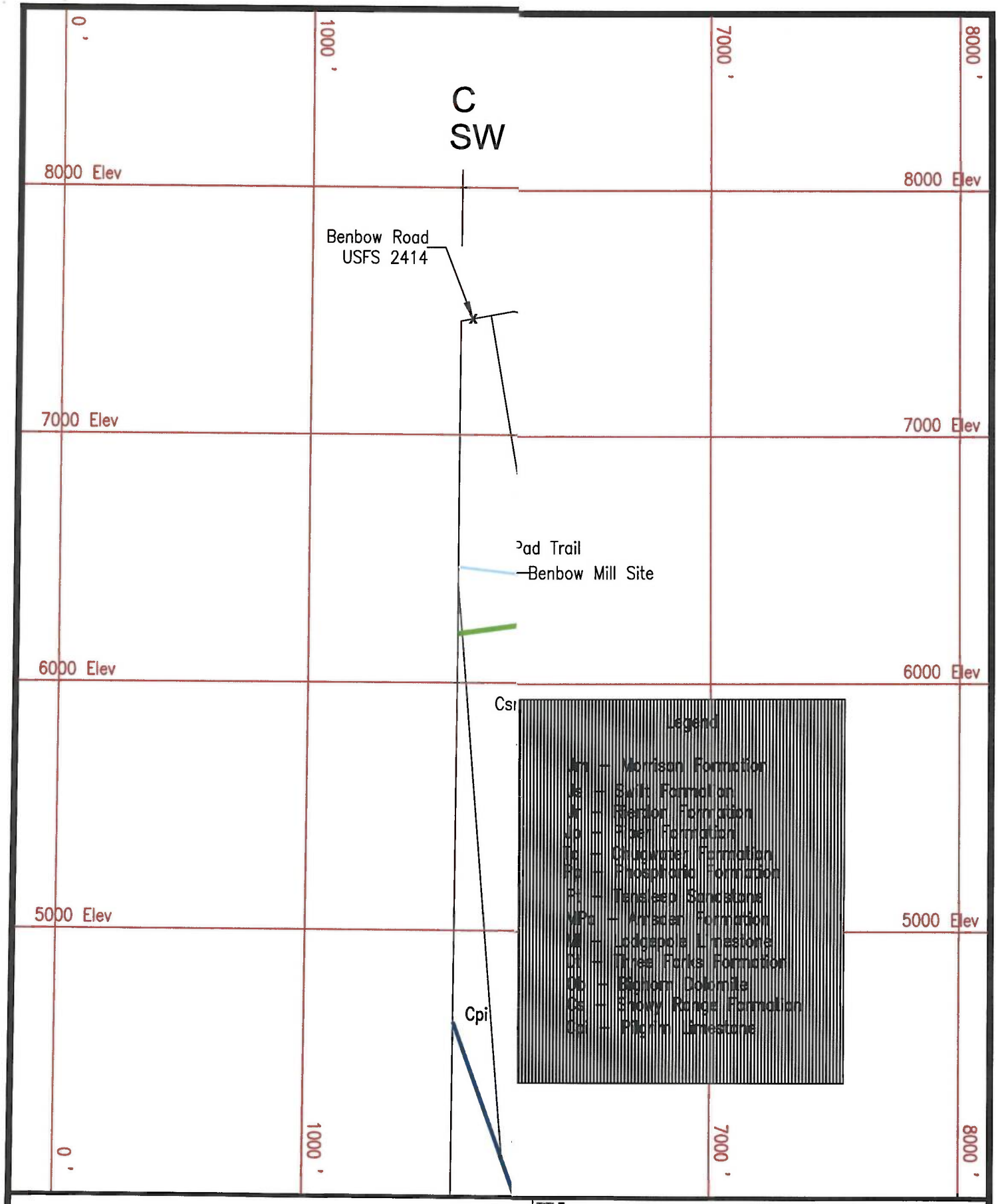

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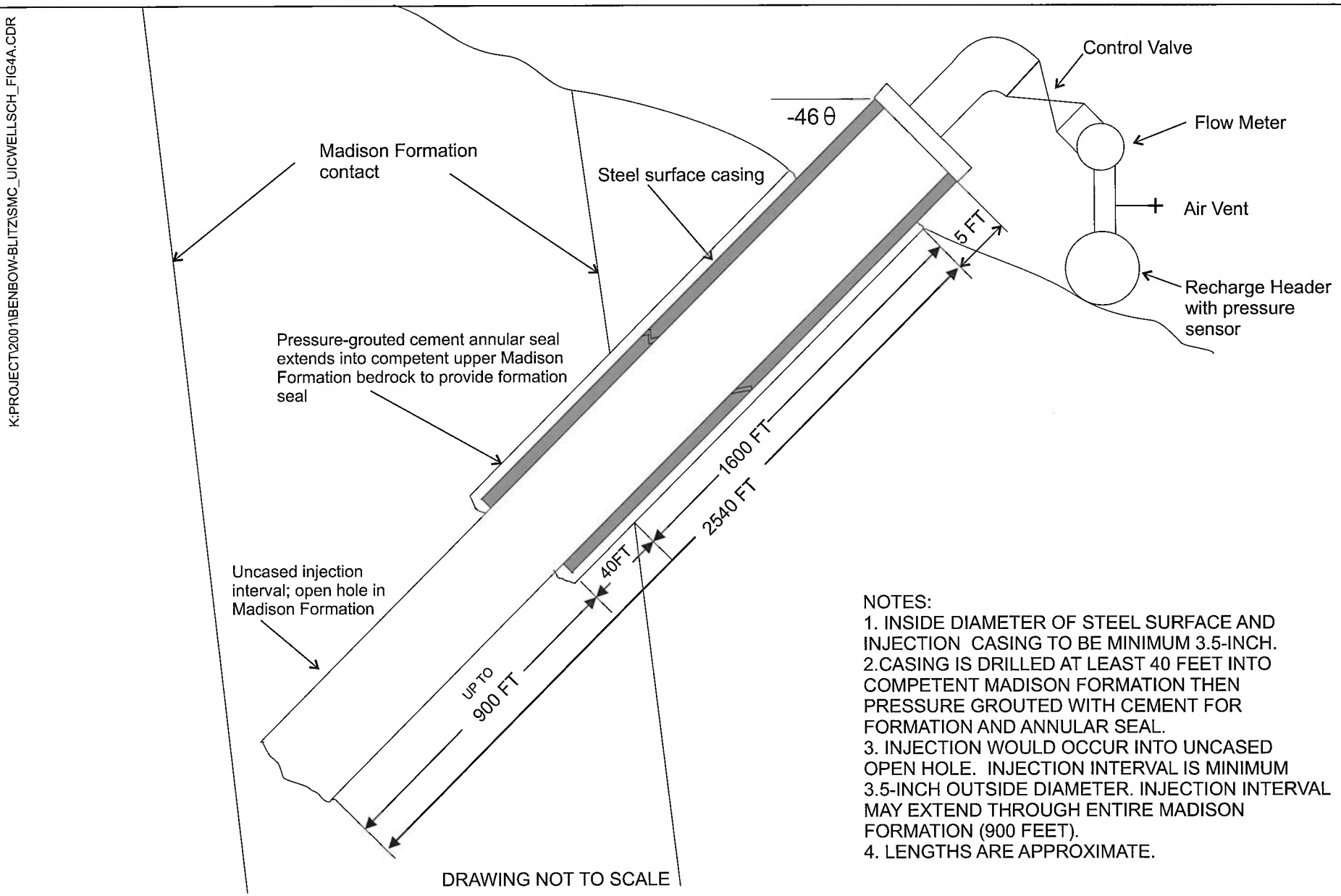

STILLWATER MINING COMPANY BENBOW EXPLORATION PORTAL CLASS V UIC WELL APPLICATION	CONCEPTUAL INJECTION WELL DETAIL	FIGURE 4A

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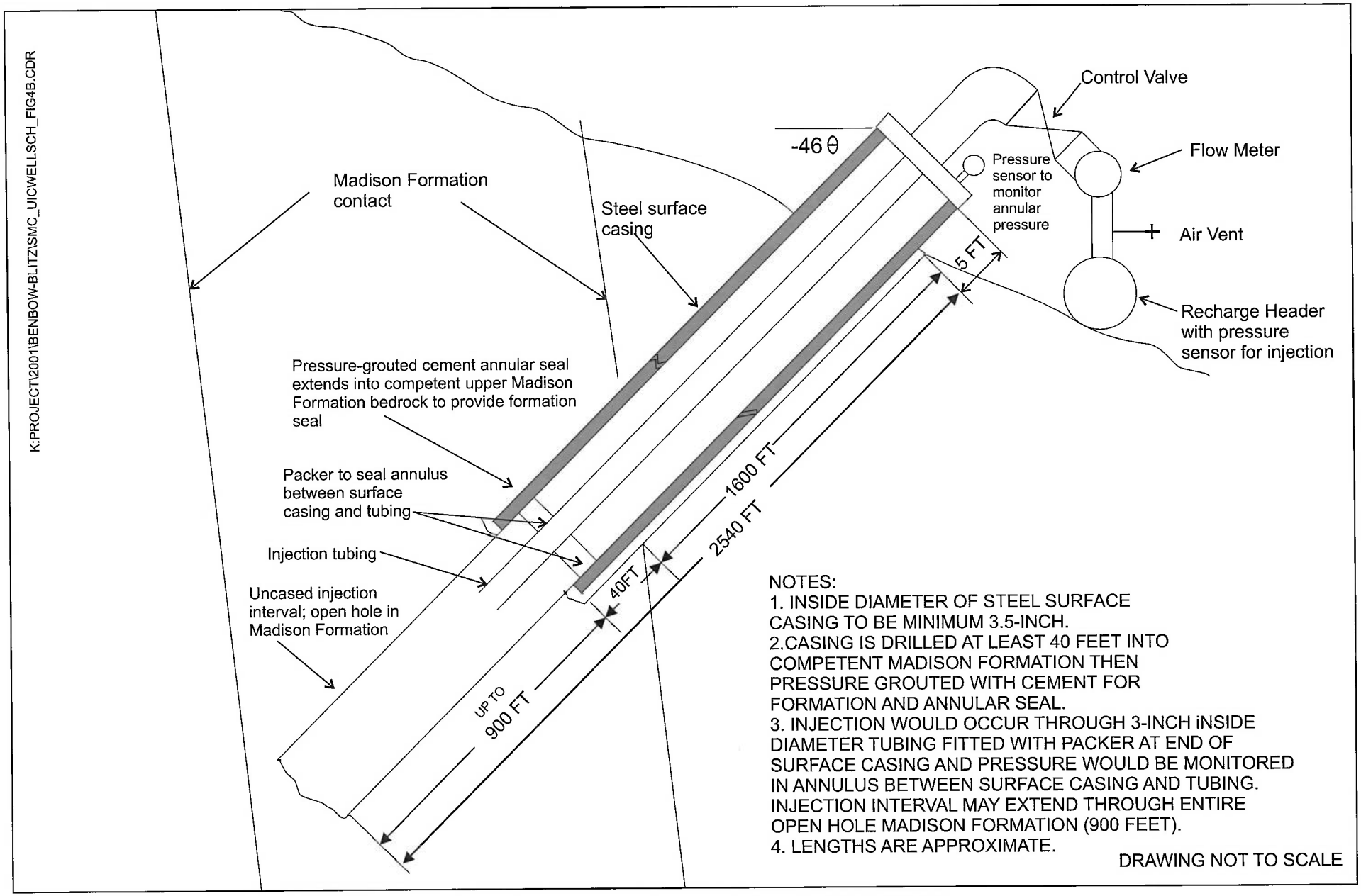

STILLWATER MINING COMPANY BENBOW EXPLORATION PORTAL CLASS V UIC WELL APPLICATION	ALTERNATE CONCEPTUAL INJECTION WELL DETAIL	FIGURE 4B

TABLE 1. 2012 QUALITY OF GROUNDWATER INTERCEPTED IN WORKINGS AND POST-TREATMENT EFFLUENT AT THE STILLWATER MINE

2012 Data	Temperature °C	pH s.u.	Alkalinity mg/L	Bicarbonate mg/L	Ammonia mg/L	Nitrate mg/L	Phosphorus mg/L	Hardness mg/L	Calcium mg/L	Magnesium mg/L	Sodium mg/L	Potassium mg/L	Sulfate mg/L
Influent - Pretreatment													
Number of samples	51	5	5	5	54	54	54	5	5	5	5	54	5
Range													
minimum	14.4	7.8	52	64	0.12	13.8	0.009	155	52	6	85	2	113
mean	18.2	7.8	63	77	0.32	24.9	0.022	176	58	7	92	2	123
maximum	21	7.8	73	88	0.81	41.7	0.039	202	64	12	105	2	138
Effluent - Post Primary Settling and Denitrification Treatment*													
Number of samples	49				49	49	49						
Range													
minimum	8.8				0.13	0.14	0.009						
mean	15.6				1.46	2.88	0.027						
maximum	20.7				3.60	15	0.085						
95th Percentile	20.3				2.72	6.33	0.065						

Notes: s.u. - standard units

* In 2012, the Stillwater Mine employed only a denitrification circuit. The biological treatment system planned for groundwater intercepted from the Benbow Exploration Portal would employ both nitrification and denitrification biological treatment. The SMC East Boulder Mine nitrification circuit achieves an average ammonia species nitrogen removal rate of 90.7 percent (with an average influent concentration 2.1 mg/L). The 2012 average ammonia species concentration in effluent at the Stillwater Mine is approximately 2 mg/L. The Stillwater Mine Benbow Exploration Portal's nitrification system is projected to achieve similar removal rates as that of the East Boulder Mine, so that the probable average effluent ammonia species concentration is about 0.2 mg/L.